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FINAL REPORT

Assessment of Geology, Energy, and Minerals (GEM) Resources

GUANO VALLEY GEM RESOURCE AREA

(OR-010-24)

LAKE and HARNEY COUNTIES, OREGON

Prepared for

United States Department of the Interior
United States Bureau of Land Management
Scientific Systems Development Branch

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March 1983

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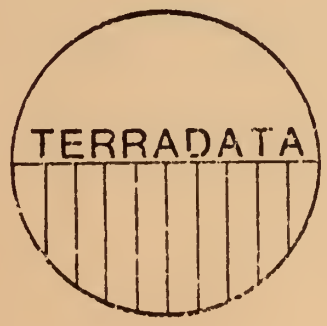

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Guano Valley GRA
(OR - 010 - 24)
Lake and Harney Counties, Oregon

Prepared For:

United States Department of the Interior
United States Bureau of Land Management
Scientific Systems Development Branch

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March, 1983

This report was prepared as part of a Phase I Assessment of GEM Resources within designated Wilderness Study Areas in Oregon, Idaho and Nevada.

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All members of the panel of experts provided valuable input into these assessments of GEM resources for each of the GEM Resource Areas (GRAs). Their professional approach to the problems and their interpretations of available literature and data form the foundation upon which the assessments for this project are based. We are grateful for their efforts and skills in this project. The panelists and their area of expertise are:

- Dr. Antonius Budding - Oil Shale and Tar Sands
- Mr. Raymond Corcoran - Field Verification
- Dr. James Firby - Paleontology
- Mr. Ralph Mason - Coal
- Mr. Richard Miller - Uranium and Thorium
- Mr. Vernon Newton - Oil and Gas
- Mr. Herbert Schlicker - Industrial Minerals and Geologic Hazards
- Dr. Walter Youngquist - Geothermal
- Dr. Paul Weis - Metals and Non - Metals.

Mr. Edwin Montgomery provided valuable insight and assistance in structuring the project and these reports in order to best serve the purposes of the Bureau of Land Management. We greatly apppreciate his assistance.

Technical assistance was provided by Mr. Frederic W. Lambie, Dr. Steve N. Yee and Dr. Terence L. Lammers of TERRADATA. Their assistance is most gratefully acknowledged.

Mr. Tom Mitchell assisted in the stream sediment sampling program. Bondar - Clegg provided the geochemical analysis of stream sediment samples.

Ms. Pamela Ruhl provided clerical and editorial assistance throughout the project. Ms. Sara Mathews assisted with occurrence information and drafting. Mr. Philip R. Jones and Mr. Michael A. Becker produced all documents relating to the project using TERRADATA's word processing and document production systems.

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EXECUTIVE SUMMARY

The purpose of this project is to evaluate and classify environments favorable for the occurrence of GEM resources in southeastern Oregon, southwestern Idaho, and northern Nevada. **(See the TERRADATA report entitled "Procedures for the Assessment of Geology, Energy, and Minerals (GEM) Resources.")** GEM resource environments have been rated on a scale that ranges from one to four, with one being least favorable and four being most favorable. Favorability classes two and three represent low and moderate favorability, respectively. Confidence levels range from A to D with A being low confidence and D being high confidence. The confidence levels are directly related to the quantity and quality of the information available for the determination of the favorability classes.

The specific area with which this report deals is the Guano Valley GEM resource area (GRA OR-010-24) which is located in south-central Oregon (see attached location map). The GRA contains about 264 square miles within Townships 38S through 41S and Ranges 27E through 29E. It contains one WSA; WSA 1-139 which comprises 65,720 acres. The study area is in the Warner Lake Resource Area of the Lakeview BLM District. It is about 54 miles from Lakeview, Oregon.

The GRA is within the Great Basin sub-province of the Basin and Range physiographic province. It contains rocks that range from Paleozoic miogeoclinal sediments to Tertiary volcanics and volcaniclastic strata. The area is west of the major structural Antler orogenic belt. Basin and Range fault blocks are common in this portion of Oregon.

The Guano Valley GRA contains several geologic environments that are variously favorable for GEM resources. The study area is classified 3C for the occurrence of bentonite deposits, the 3C rating signifies that the geologic environment, the inferred geologic processes and the reported mineral occurrences indicate moderate favorability for the accumulation of bentonite, and that the available data provide direct evidence but are quantitatively minimal to support the possible existence of mineral resources. The study area also contains environments similar to those found in other Tertiary basins in which diatomite deposits occur. The confidence level (A) for the classification of the area for potential diatomite resources signifies that although the necessary geologic environment is believed to be present, there is no evidence to support or refute this evaluation.

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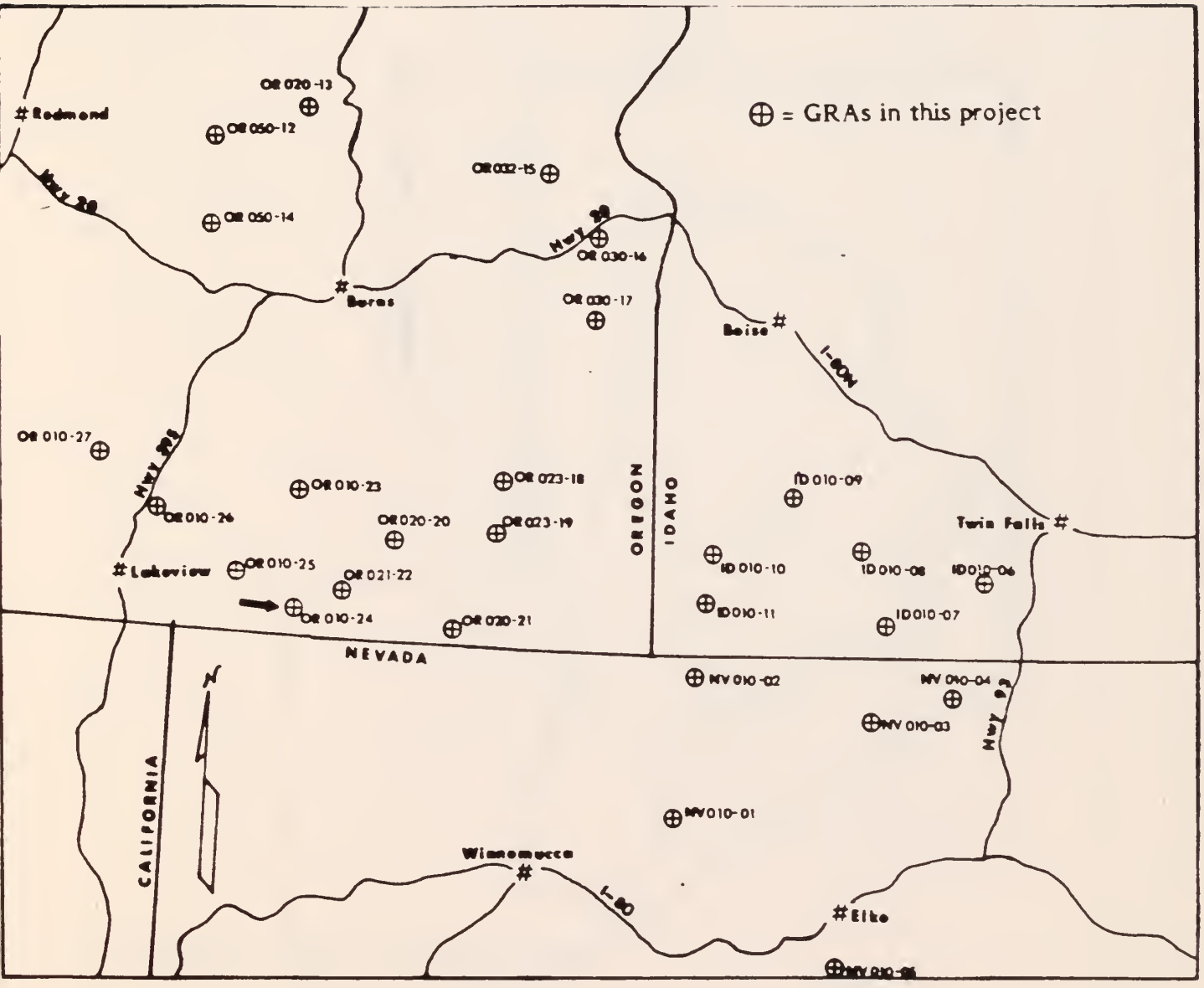
GRA Location Map



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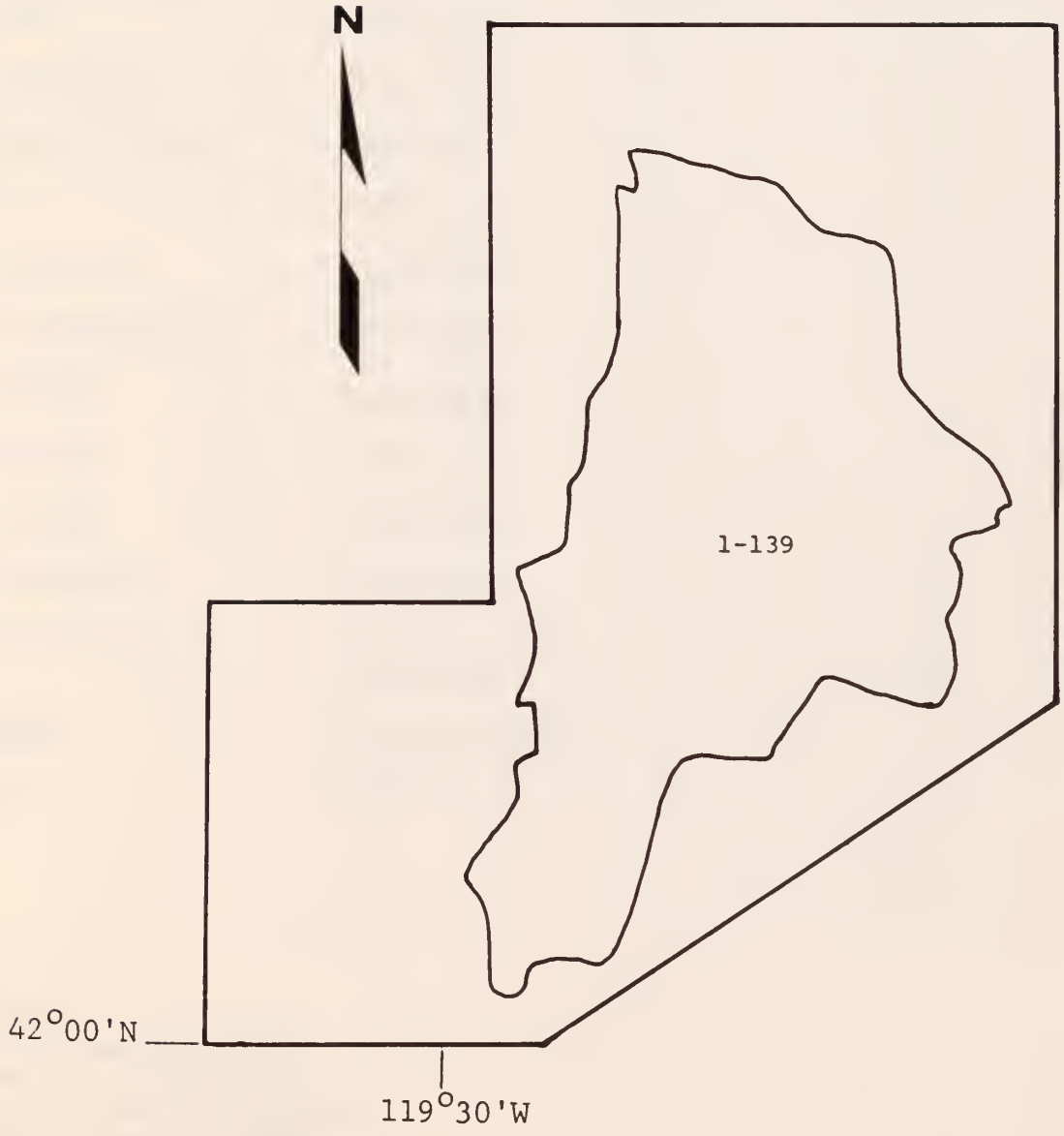
Land Classification Map
Guano Valley GRA
(OR - 010 - 24)
Lake and Harney Counties, Oregon



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Classification Of Lands Within The
Guano Valley GRA
(OR - 010 - 24)
Lake and Harney Counties, Oregon
For GEM Resource Potential

COMMODITY	AREA	CLASSIFICATION LEVEL	CONFIDENCE LEVEL	REMARKS
Metals	Entire GRA	2	B	Hg
Geothermal	Entire GRA	2	B	
Uranium/Thorium	Entire GRA	1	A	
Coal	Entire GRA	2	B	
Oil and Gas	Entire GRA	2	A	
Tar Sands/Oil Shale	Entire GRA	1	C	
Limestone	Entire GRA	1	C	
Bentonite	Entire GRA	3	C	
Diatomite	Entire GRA	3	A	
Clinoptilolite	Entire GRA	1	A	
Paleontology	S.W. part of GRA	4	D	
	Rest of GRA	1	B	
Hazards	See Hazards Map (GRA File)			
ESLs	None	1	C	

LEGEND:
Class 1 - least Favorable
Class 2 - Low Favorability
Class 3 - Moderate Favorability
Class 4 - High Favorability

Confidence Level A - Insufficient data or no direct evidence
Confidence Level B - Indirect evidence available
Confidence Level C - Direct evidence but quantitatively minimal
Confidence Level D - Abundant direct and indirect evidence

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The entire GRA is favorable (Class 2) for mercury, coal, oil and gas, geothermal, and paleontological resources (see attached table). The potential for paleontological resources is classified 4D in the southwestern part of the GRA where mammalian fossils are known to occur; other parts of the GRA are classified 1B for these resources.

TERRADATA recommends that further surface geologic investigations be undertaken in the Guano Valley GRA in order to increase confidence levels in the classifications. Detailed geologic mapping and geochemical investigations would be useful in upgrading the land classification of this area. Selective drilling of geochemical and/or geophysical anomalous areas would contribute to the refinement of the confidence level and favorability rating in this GRA.

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1. INTRODUCTION

This report is one of 27 GRA technical reports that summarize the results of a Phase 1 assessment of the geology, energy, and minerals (GEM) resources in selected portions of southeastern Oregon, southwestern Idaho, and northern Nevada. The study region was subdivided into 27 GEM resource areas (GRAs), principally for ease of data management and interpretation. The assessment of GEM resources for this project consisted of an interpretation of existing literature and information by experts knowledgeable in both the geographic area and specific commodities. It is possible that the assessment would be different if detailed field exploration, geochemical sampling, and exploratory drilling programs were undertaken. (See the TERRADATA report entitled "Procedures for the Assessment of Geology, Energy, and Minerals (GEM) Resources.")

This report summarizes the assessment of the GEM resources potential of the Guano Valley GRA (OR-010-24). See Figure 1-1. Commodity categories for which this GRA was evaluated are:

- Metals
- Oil and Gas
- Oil Shale and Tar Sands
- Geothermal
- Uranium and Thorium
- Coal
- Industrial Minerals
- Paleontological Resources
- Geologic Hazards
- Educational and Scientific Localities (ESLs)

Geologic environments within the Guano Valley GRA have been rated with respect to their favorability for the occurrence of these different commodities. The favorability rating scale ranges from one to four, with one being least favorable and four being most favorable. Confidence levels in these ratings also have been assigned. These confidence levels range from A to D, with A being low confidence and D high confidence. Assigned confidence levels are related to the quantity and quality of the information available for the determination of the favorability ratings.

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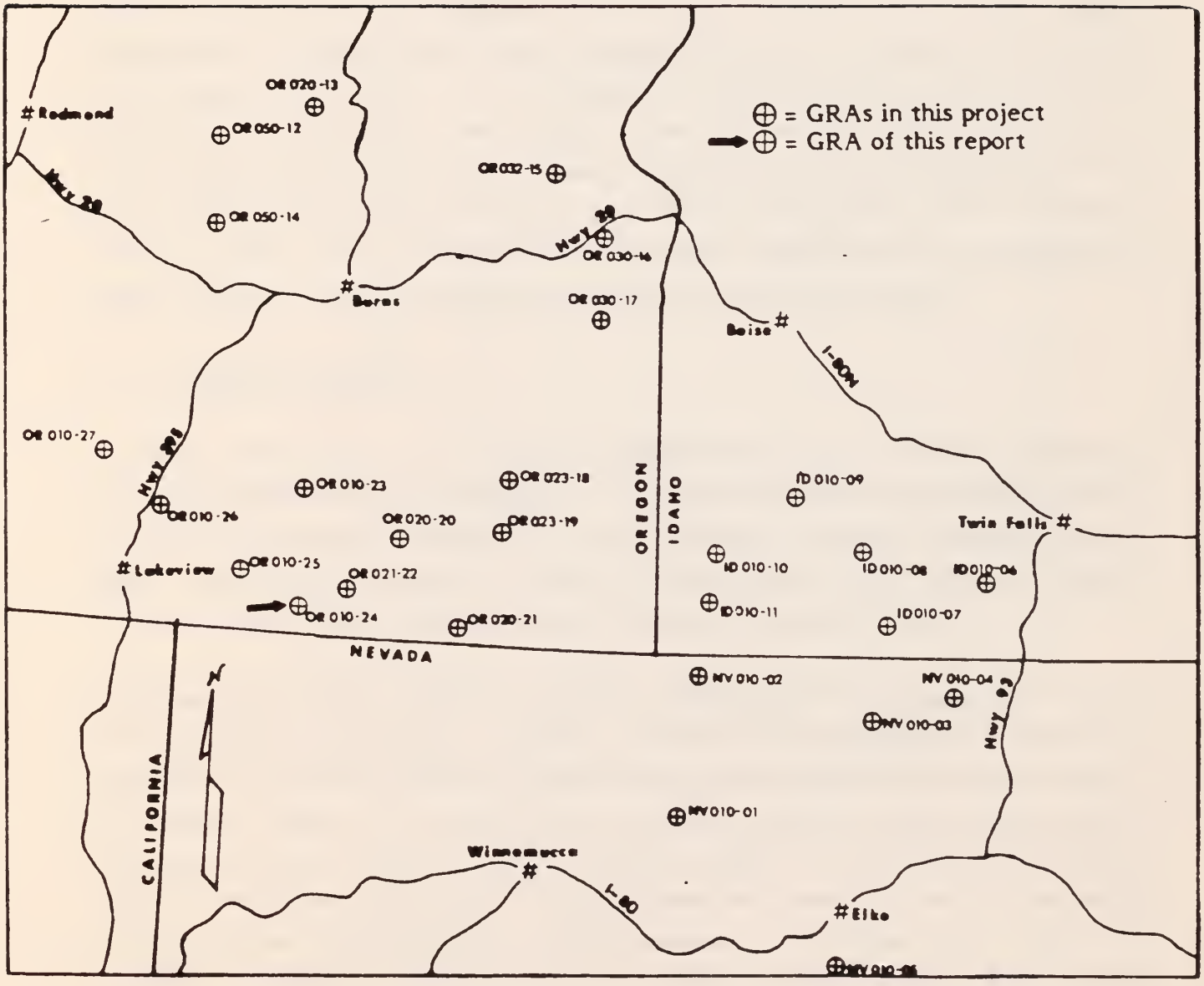
FIGURE 1-1

GRA Location Map



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2. DESCRIPTION OF THE GUANO VALLEY GRA

2.1 LOCATION

The Guano Valley GRA (OR-010-24) is in south-central Oregon. It lies between latitudes 42°00'N and 42°21'N and longitudes 119°15'W and 119°37'W. The GRA contains approximately 264 square miles within Townships 38S and 41S and Ranges 27E and 29E (see Figures 1-1 and 2-1). The area contains one Wilderness Study Area; WSA 1-139 (65,720 acres). The Guano Valley GRA is in the Warner Lakes Resource Area of the Lakeview BLM District. The area is about 54 miles from Lakeview, Oregon which is the nearest transportation center offering a minimum of rail, highway, and/or charter-air services. Access to the contained WSA is via county maintained dirt or packed-gravel roads. Vehicular access to the interior of the WSA is poor to non-existent.

2.2 GENERAL GEOLOGY

The Guano Valley GRA is in the Adel 1°x2° NTMS Quadrangle. The data available for this area includes NURE investigations[1, 2, 3]*, general mineral resource information[4], and small scale geologic mapping[5]. Detailed geologic information is lacking in most areas. Occurrence information for this GRA includes MILS, CRIB, claims, and leases. The overall quantity and quality of commodity specific information is poor.

The Guano Valley GRA is within the northern section of the Great Basin portion of the Basin and Range physiographic province. The Basin and Range Province consists of generally north-trending fault-block mountains separated by parallel intermontane basins. The mountain blocks are commonly ten to twelve miles wide and are separated by alluviated valleys of comparable width. Elevation ranges from below sea-level at Death Valley to more than 13,000 feet at White Mountains Boundary Peaks. Local relief generally is less that 5,000 feet. The physiography of the Great Basin reflects the structural and lithologic complexity of the underlying bedrock. The Great Basin portion of the Basin and Range Province extends from southern Nevada northward into southern Oregon. The northern-most extremity is located just north of the town of Burns, Oregon.

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* In this report, citations are superscripted numbers. They refer to bibliographic entries listed in Appendix A, References Cited.

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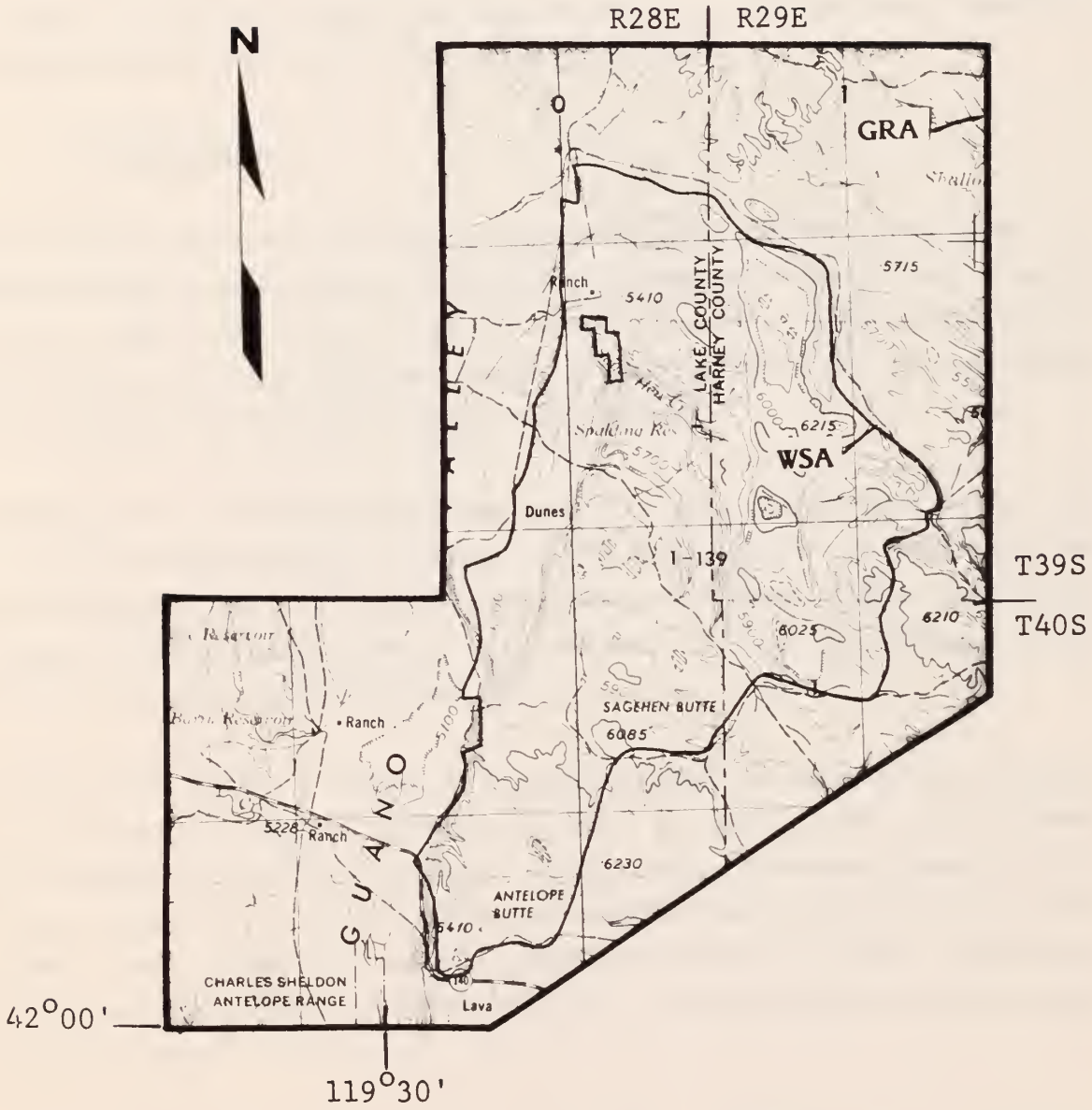
FIGURE 2-1

Topographic Map
Guano Valley GRA
(OR-010-24)
Lake and Harney Counties, Oregon



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The part of the Basin and Range Province that lies in southern Oregon extends eastward from the Cascade Range to the eastern limits of the Trout Creek Mountains. This part of the province is dominantly underlain by Cenozoic volcanic strata. Pre-Tertiary rocks are exposed in only two places in the Oregon part of the Basin and Range Province; in the Pueblo Mountains and in the Trout Creek Mountains of southeastern Harney County. Very little is known about the Pre-Tertiary basement elsewhere in the province. A sparce amount of data is available regarding the depth to the Pre-Tertiary basement rocks and the thickness and nature of the Tertiary cover rocks.

2.2.1 Geomorphology

The Guano Valley GRA is about 50 percent upland area and 50 percent lowland area. The two geomorphological sub-sections are separated by a prominent north-northeast trending fault scarp. Guano Valley is one of seven prominent sub-parallel grabens in the Oregon part of the Basin and Range Province. Other grabens for which GRAs have been named include Crump Lake Valley, Catlow Valley, and Pueblo Valley.

The western part of the GRA, Guano Valley proper, consists of a flat-lying playa. The playa is 20 miles long and six miles wide and extends northward from the Oregon-Nevada border. The playa contains one large ephemeral lake, two smaller perennial lakes fed by intermittent streams flowing from the west and south. Other characteristics of the playa include relict beach ridges and dune fields.

The eastern upland surface is bounded by a prominent scarp that extends from Antelope Butte, in the south, to the foot of Beaty's Butte in the north. WSA 1-139 is almost entirely contained within this upland area. This scarp defines the western edge of a fault block that is tilted to the northeast. The scarp becomes less pronounced to the north. Intermittent streams drain the northern portion of the WSA and flow southeast to northwest across the northern end of the fault scarp. Numerous ephemeral lakes occur on the upland surface.

Total relief in the Guano Valley GRA is 1,610 feet. Antelope Butte is the area of greatest local relief, 1,300 feet, and the highest point in the GRA. The lowest point is in the bottom of Guano Valley. Guano Valley has no external drainage.

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2.2.2 Lithology and Stratigraphy

Paleozoic and Mesozoic units may occur at undetermined depths in the Guano Valley GRA since this area is within the margins of both the western Triassic and the western Late Paleozoic depositional basins[6]. None of these units, however, is exposed in or near the GRA. Tertiary basalt flows are the oldest rocks exposed in the Guano Valley GRA (Figure 2-2).

The majority of rocks in this GRA are Tertiary volcanogenic strata. The Tertiary volcanic rocks comprise three major groups distinguished on the basis of chemistry and age. Eocene (?) to Early Miocene basaltic to rhyolitic rocks underlie areas throughout the GRA. These rocks are part of widespread calc-alkalic volcanism related to subduction along the Pacific margin, which produced mostly andesitic to rhyolitic rocks.

Representatives of the second Tertiary volcanic group, Mid-Miocene dacitic to rhyolitic ash-flow tuffs and flows, occur throughout the GRA. Some of these rocks are peralkaline or have peralkaline affinities. They are related to the beginning of extensional tectonics in the area.

A third volcanic group consists mostly of Middle to Late Miocene olivine basalt flows. These rocks are probably correlative with the flood basalts of the Columbia River Plateau Province. Relatively young basalt flows and other volcanic ejecta occur in the northern part of the GRA.

Volcaniclastic rocks are associated with the second Tertiary volcanic group and consist mainly of tuffaceous fluvio-lacustrine shales, mudstones, sandstones, and conglomerates. Air-fall tuff and diatomaceous sedimentary rocks also occur. Vertebrate and invertebrate fauna from localities near the GRA indicate a Barstovian (Late Miocene) age for these rocks[7]. Quaternary exogenous domes, flows, and flow breccias of rhyodacitic composition occur in the northern part of the Guano Valley GRA. A small amount of Quaternary basalt and/or andesite also occurs in this part of the study area.

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FIGURE 2-2

Geologic Map
Guano Valley GRA
(OR-010-24)
Lake and Harney Counties, Oregon

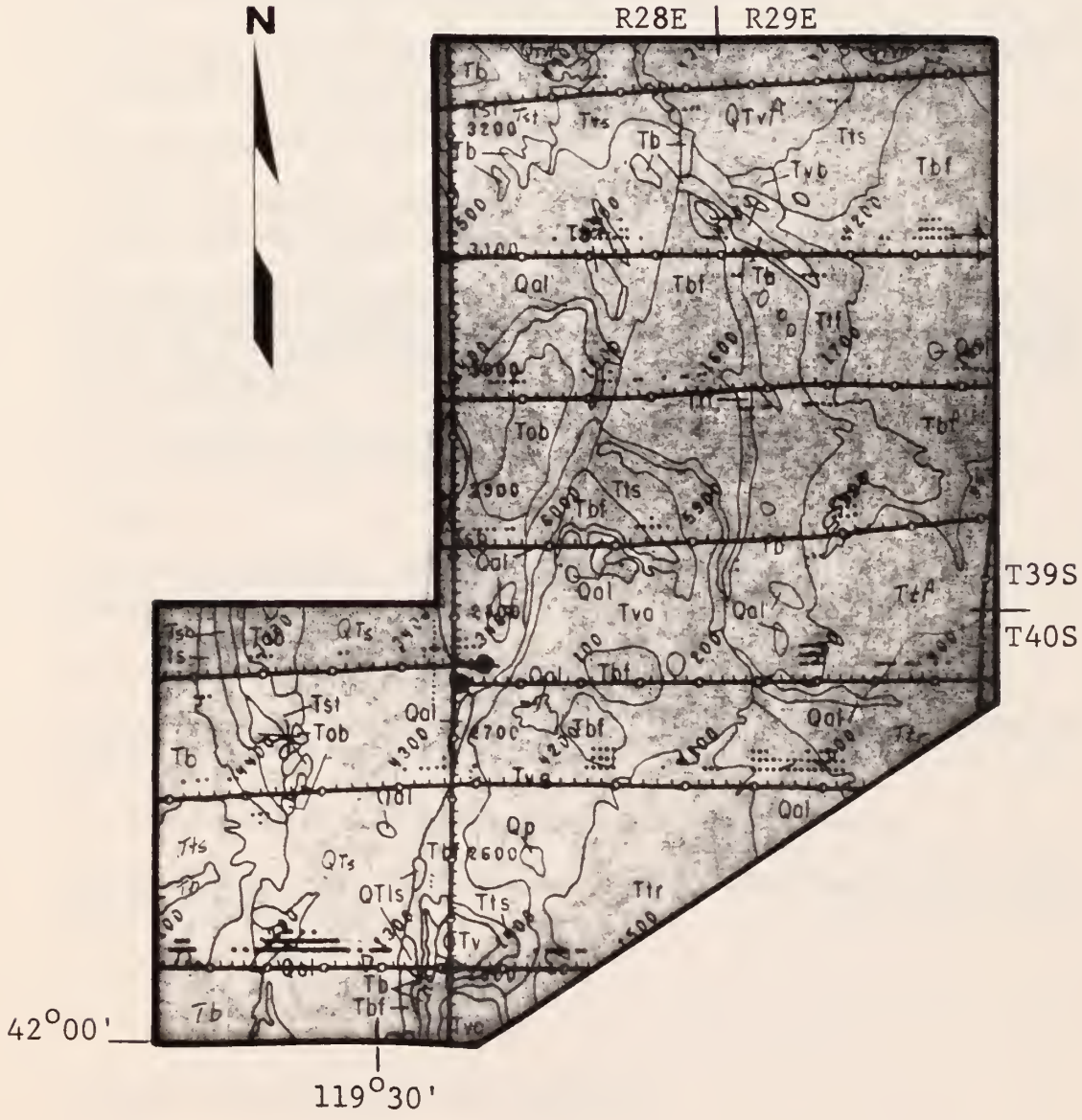

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FIGURE 2-2
(Continued)

Geologic Map Legend For
Guano Valley GRA
(OR-010-24)
Lake and Harney Counties, Oregon

Qal	-	Alluvium
QTls	-	Landslide Debris
QTs	-	Lacustrine, Fluviatile, and Aeolian Sedimentary Rocks
QTvf	-	Large, Complex Exogeneous Domes and Related Flows and Flow Breccias of Rhyodacitic Composition
QTvm	-	Strato-Volcanoes Dominantly of Basaltic or Andesitic Composition
Tsb	-	Tuffaceous Siltstone, Sandstone, Conglomerate, Tuff, and Interbedded Basalt or Andesite Flows
Tst	-	Semiconsolidated Lacustrine Tuffaceous Sandstone and Siltstone, Ash and Ashy Diatomite, Conglomerate and Minor Fanglomerate, Boulder-Bearing Slope Wash, Vitric-Crystal and Vitric-Lithic Tuff, Pumice Lapilli Tuff, and Tuff Breccia
Tob	-	Thin, Vesicular, Subophitic to Intergranular, Diktytaxitic Basalt Flows
Tb	-	Basalt
Ttf	-	Rhyolitic and Dacitic Tuff, Tuffaceous Sedimentary Rocks, and Areally-Restricted, Rhyodacitic Flows
Tts	-	Fine-Grained Tuffaceous Sedimentary Rocks and Tuffs
Ttr	-	Partly to Densely Welded Tuffs and Areally-Restricted Rhyolite or Dacite Flows
Tbf	-	Massive Basalt Flows and Minor Interbeds of Tuff and Scoria
Tva	-	Flows of Platy Andesite and Basaltic Andesite, with Glassy, Black or Grey Dacite or Rhyodacite
Tvb	-	Thin, Discontinuous Basalt Flows
	-	Geologic contact (dashed where inferred).

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2.2.3 Structural Geology

The tri-state area of northeastern Nevada, southern Oregon, and southwestern Idaho is characterized by several major structural elements. During the Early Paleozoic this area was the site of marine sedimentation in the north-northeast trending Cordilleran geosyncline. Sedimentation persisted in three sub-parallel belts until the end of the Devonian Period. One sedimentation belt was located in the eastern half of Nevada and received nearshore to littoral deposits of shallow-water carbonates with a minor amount of interbedded shale and sandstone. The second sedimentation belt was in the western half of the state and was the locus of transitional, progressively deeper water deposits. The third belt, located further west, was the site of eugeoclinal deposits.

In Late Devonian time, the Antler Orogeny developed along a north-northeast trending swath through northwest Elko County, Nevada, and on into southwestern Idaho. The Guano Valley GRA lies approximately on the axis of the Antler orogenic belt. As a direct result of the Antler orogenic uplift, a Pennsylvanian clastic wedge developed along the margins of the uplift. The orogeny culminated in a period of extensive thrust faulting that includes the Roberts' Mountain thrust.

The Sonoma Orogeny occurred in the Permian in north-central Nevada[6]. This deformational episode included more thrust faulting in the vicinity of the Guano Valley GRA.

Another structrual episode in this area was Basin and Range block faulting in response to extensional forces.

2.2.4 Paleontology

Late Tertiary and Early Quaternary sedimentary rocks within the GRA contain several varieties of flora and fauna. Tuffaceous lacustrine sediments contain Late Miocene (Barstovian age) mammalian vertebrate fauna in fine-grained sandstone and siltstone facies[7]. Tertiary diatomites contain occasional fish and leaf fossils common to lacustrine environments. All other exposed volcanic lithologies are essentially devoid of fossils. Older fossil-bearing Paleozoic and Mesozoic marine and terrigenous units are not exposed in the Guano Valley GRA.

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2.2.5 Historical Geology

The present geologic character of the Great Basin resulted from the progressive development of the western portion of the North American continent throughout geologic time. Beginning in the Late Precambrian and continuing into the Middle Paleozoic, eastern Nevada, western Utah, southwesternmost Idaho were characterized by a miogeoclinal environment in which shelf margin carbonates, shales, and sandstones were deposited. In contrast, western Nevada and southern Oregon were in a eugeoclinal environment in which dark shales, radiolarian cherts and basaltic materials (Steinman's Trinity) were formed.

The Middle Paleozoic (Late Devonian-Early Mississippian) Antler Orogeny deformed and thrust the eugeoclinal sediments over the shelf-type sediments to the east, resulting in a north-trending highland in Central Nevada (see Figure 2-3). A vast amount of fine-grained detritus was shed eastward during the Mississippian, producing thick upper Paleozoic shales in eastern Nevada and western Utah. Erosion of the Antler Highlands resulted in the deposition of coarse sediments during the Early Pennsylvanian. Thousands of feet of sandstone and conglomerate were deposited in northern Nevada arond the margins of the Antler Highlands. Late Pennsylvanian and Permian shallow water sediments overlapped and overstepped the roots of the eroded highlands. Sediments deposited over the eroded Antler Highlands in the Permian were predominantly of the deep-water variety. The next significant tectonic episode (the Sonoma Orogeny) thrust the ocean floor siliceous and volcanic materials eastward over the shallow water, clastic sedimentary rocks that covered the ancient Antler Highland.

Development of western North American in the Mesozoic was dominated by oceanic plate subduction along the continental margin that resulted in a complex history of concomittant sedimentation, deformation, and igneous activity. During this time, the well-defined overthrust belt that extends from Canada to Mexico was formed. This deformation occurred during the Sevier (Late Jurassic to Latest Cretaceous) and Laramide orogenies (Latest Cretaceous to Early Tertiary Eocene)[8].

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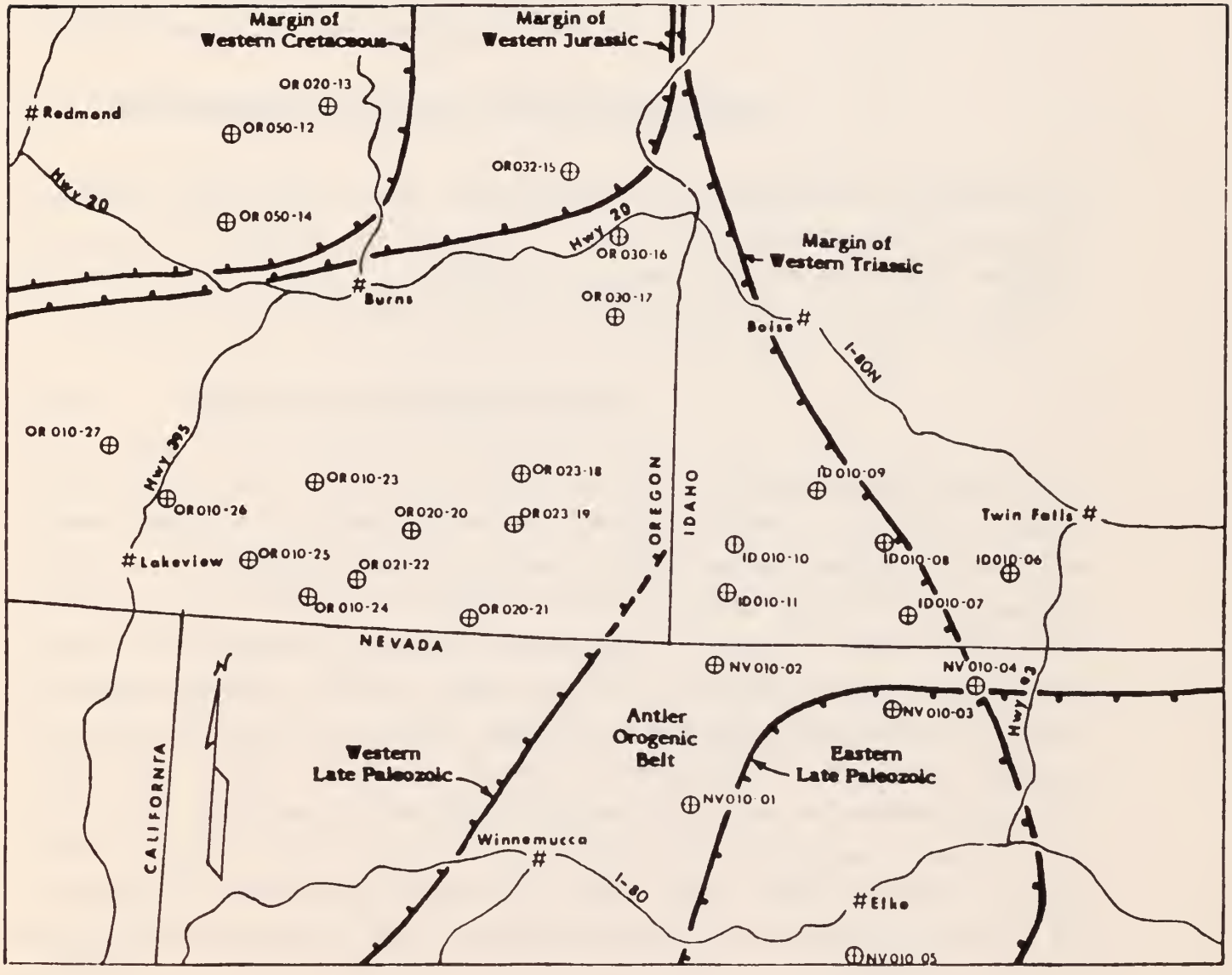
FIGURE 2-3

Paleogeographic Map[6]
Oregon-Idaho-Nevada
Tri-State Area



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Widespread silicic volcanic rocks formed in the Great Basin in Early and Middle Cenozoic time (primarily 20-34 million years ago). During Late Cenozoic time volcanic activity of the Great Basin changed to a bimodal basalt-rhyolite assemblage that reflects the taphrogenic character of the region. It was also during this time that the tectonic character of the region changed from one of compression to one of extension and led to the development of the Basin and Range structure.

2.3 ENVIRONMENTS FAVORABLE FOR GEM RESOURCES

The Guano Valley GRA contains environments that are moderately favorable for the occurrence of diatomite and bentonite. It also contains environments that have low favorability for metallic, geothermal, coal, and oil and gas GEM resources. Environments for all other GEM resources are not favorable in the Guano Valley GRA.

2.3.1 Environments for Metals Resources

Tertiary units within the Guano Valley GRA are known to contain hydrothermal mercury deposits elsewhere in southeastern Oregon. Recognition criteria for this type of deposit include the occurrence of cinnabar, evidence of hydrothermal alteration, often intense silicification, the presence of available structural sites and the presence of associated sulfides. The process of mercury mineralization is driven by related Tertiary and Quaternary volcanism. Indirect evidence for all of the above criteria, except for the occurrence of mercury and related sulfides and alteration, occurs within the Guano Valley GRA. Basin and Range faulting had provided the conduits for ascending hydrothermal fluids and the requisite structural preparation for mineralization sites. Tertiary and Quarternary volcanics occur throughout the study area. However, direct evidence that mineralizing processes have taken place within the GRA is lacking. Environments favorable for other metallic GEM resources are not anticipated in this area[21].

2.3.2 Environments for Oil and Gas Resources

The Guano Valley GRA has a low favorability for potential oil and gas resources. Potentially favorable sub-surface environments include western Triassic and western Late Paleozoic formations, and Miocene Lake Bruneau units[6]. Prospective environments are overlain by Tertiary volcanics, therefore, all of the evidence is

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indirect. If the environments favorable for the accumulation of oil and gas do exist, then the associated Basin and Range faults might provide essential structural traps.

2.3.3 Environments for Oil Shale and Tar Sands Resources

The Guano Valley GRA contains no environments favorable for the occurrence of oil shale or oil impregnated sand[9]. The area is underlain predominantly by Tertiary volcanics. Potential sedimentary hosts are largely tuffaceous and contain only minor amounts of non-volcanic clastic material and carbonates. Favorable lithologies are not present.

2.3.4 Environments for Geothermal Resources

The Guano Valley GRA has a low favorability for geothermal resources. Structural criteria are met by Basin and Range faults associated with the Guano Valley graben. Young volcanics occur within the GRA. However, there is no direct evidence in the form of known geothermal occurrences to support this evalutation[10].

2.3.5 Environments for Uranium and Thorium Resources

There are no environments favorable for the occurrence of uranium or thorium resources in the Guano Valley GRA[11]. Favorable source rocks, potential reductants, and evidence of inferred processes of mineralization are all lacking in this study area.

2.3.6 Environments for Coal Resources

The Guano Valley GRA contains low favorability for the occurrence of coal and lignite deposits[12]. The chances for coal or carbonaceous materials to have formed in the study area are remote. The geology of the Guano Valley GRA region does not support environments favorable for the formation of coal deposits. The area is underlain or is mantled with accumulations of highly tuffaceous sediments and related volcanic products. There is no evidence to support the inference that a coal-forming environment existed within this GRA.

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2.3.7 Environments for Industrial Minerals Resources

The Guano Valley GRA contains environments favorable for the accumulation of diatomite and bentonite GEM resources. Environments favorable for diatomite occur in lacustrine strata interbedded with volcanic sequences. Bentonite may occur as an alteration product of felsic volcanic rocks in the GRA[13].

2.3.8 Environments for Paleontological Resources

The Guano Valley GRA contains one environment that is highly favorable for paleontological resources. Tuffaceous lacustrine sediments in the southwest part of this area (Figure 2-2, map unit Tst) contain two Miocene vertebrate fossil localities and occasional leaf and fish fossils. Most of the other lithologies within the GRA have low favorability for these resources[7].

2.3.9 Environments for Geologic Hazards

Potential geologic hazards in the Guano Valley GRA consist of mapped and interpreted faults, landslides, and volcanic centers[13]. These features were noted from aerial photographs, geologic maps, and topographic maps. There is no historical record of violent seismic or volcanic activity the area. The potential for mass movement exists along all the over-steepened slopes within the GRA.

2.3.10 Educational and Scientific Localities

There are no known ESLs in the Guano Valley GRA.

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3. ENERGY AND MINERAL RESOURCES IN THE GUANO VALLEY GRA

The Guano Valley GRA has an overall low favorability for the occurrence of GEM resources.

3.1 KNOWN DEPOSITS

The Guano Valley GRA has no known deposits.

3.2 OCCURRENCES

The Guano Valley GRA contains one CRIB locality (Figure 3-1), no MILS localities, and no NURE localities. The sole CRIB locality is an unnamed uranium prospect in the eastern part of the study area.

3.3 CLAIMS

The Guano Valley GRA contains no known claims as of 15 August, 1982.

3.4 LEASES

Sixtyfive percent of the Guano Valley GRA, including most of WSA 1-139, is currently leased or under lease applications. Lease information is current as of 15 August, 1982.

3.5 DEPOSIT TYPES

Deposits, other than minor hydrothermal mercury deposits, are not anticipated in the Guano Valley GRA.

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FIGURE 3-1

CRIB Localities Map
Guano Valley GRA
(OR 010-24)
Lake and Harney Counties, Oregon

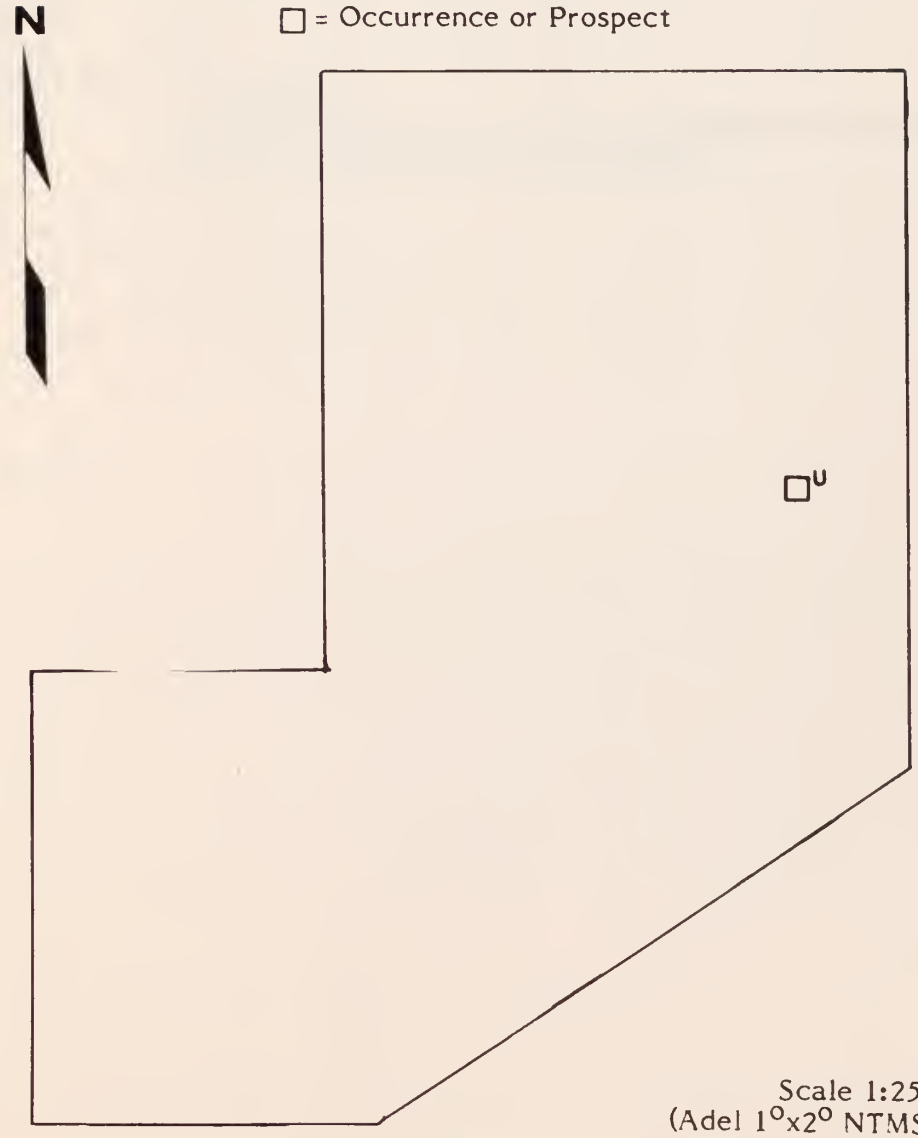

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FIGURE 3-1

Legend For
CRIB Localities Map
Guano Valley GRA
(OR 010-24)
Lake and Harney Counties, Oregon

1. CRIB No.: M029021
   Location Name: Unnamed
   Latitude: 42°-11'-10"N
   Longitude: 119°-17°-20"W
   Commodities: Uranium
   Production: None
   Production Size: Not Applicable
   References: Erikson, E.H., and Curry, W.E.; 1977; Unites States Department of Energy Open-File Report GJBX-92(77)

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3.6 MINERAL ECONOMICS

The two commodities for which the Guano Valley GRA is considered most favorable are bentonite and diatomite.

3.6.1 Bentonite

The primary uses of bentonite are in drilling mud, foundry sand, Portland cement, filtrates, pond and reservoir sealing, and for pelletizing (iron ore). Wyoming, Montana, and California are the chief producers of high-swelling, or sodium, bentonites. Missouri, Pennsylvania, and Ohio are the chief producers of low-swelling, or calcium, bentonites[14].

The United States is a net exporter of all clays. The demand for all clays is expected to increase at an annual rate of between two percent and four percent through 1990. The United States' position as a major supplier of clays is enhanced by the possession of more than adequate resources and the technology necessary to process large amounts of high-quality clays[15].

3.6.2 Diatomite

Diatomite is used primarily as a filter-aid, as an industrial filler, and other miscellaneous applications, including insulation[16]. Diatomite was produced by seven companies in four states in 1981[17]. California accounted for more than 50 percent of total diatomite production. The United States is the largest world producer and consumer of diatomite. The United States, however, is a net exporter of this commodity. Demand for diatomite is expected to increase at an annual rate of three percent through 1990. World resources of diatomite are adequate for the foreseeable future, but the need for near-market sources will encourage development of new sources.

3.7 STRATEGIC AND CRITICAL MINERALS AND METALS

Mercury is the only strategic commodity for which the Guano Valley GRA is considered favorable. (See Table 3-4 in TERRADATA's report entitled "Procedures for the Assessment of Geology, Energy, and Minerals (GEM) Resources.") The entire GRA is classified as having a low favorability (Class 2B) for mercury.

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4. CLASSIFICATION OF LAND FOR GEM RESOURCES POTENTIAL

The precise location of specific favorable environments within a given GRA depends upon three principal factors:

- The precision and specificity of avaliable data;
- The nature (size and spatial distribution) of anticipated deposits as predicted from known models; and
- The geometry of the favorable geologic environments.

Commodity-specific information in the Guano Valley GRA is limited. Subsurface information is virtually non-existent. Therefore, the entire area, rather than specific subareas, has been classified for individual GEM resources (Figure 4-1 and Table 4-1).

The entire Guano Valley GRA is moderately favorable (Class 3) for diatomite and bentonite resources. The geologic environments for these resources are common in the Tertiary volcanic sequences that occur in the study area. The confidence levels for diatomite and bentonite evaluations are A and C respectively. An A confidence level signifies a scarcity of available data. The C confidence level indicates the availability of minimal direct evidence.

The entire GRA has a low favorability (Class 2) for several GEM resources. These are mercury, geothermal, coal, and oil and gas potential resources. A Class 2 favorability indicates that the geologic environment and inferred geologic processes demonstrate a low favorability for the accumulation of these commodities. The confidence levels for these commodities range from A to B, dependent on the availability of supportive indirect evidence.

The classification (2B) of the area as having a low favorability for the accumulation of oil and gas resources agrees with the USGS classification of the same area[18]. TERRADATA's classification of the area for other leasables also is in agreement with the USGS evaluation, with the exception of potential sodium deposits of the Guano Valley playa[19, 20]. The playa was not evaluated by TERRADATA's panelists for sodium because subsurface information is virtually non-existent in this area. The Guano Valley GRA does not exhibit favorable characteristics (Class 1) for other commodities listed in Table 4-1.

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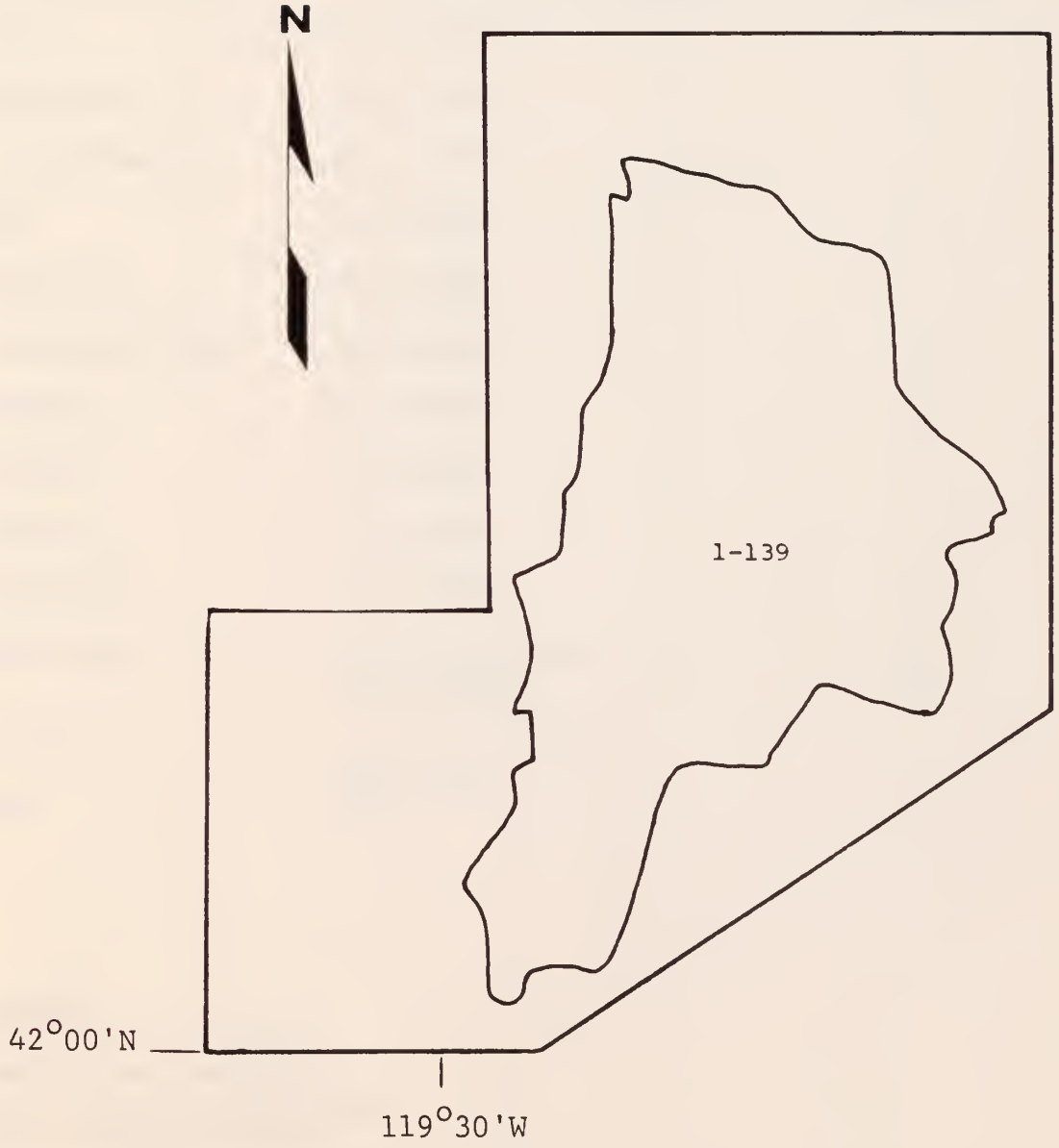
FIGURE 4-1

Land Classification Map
Guano Valley GRA
(OR-010-24)
Lake and Harney Counties, Oregon



Scale 1:250,000
(Adel 1°x2° NTMS Quadrangle)

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Table 4-1

Classification Of Lands Within The Guano Valley GRA (OR - 010 - 24) Lake and Harney Counties, Oregon For GEM Resource Potential

COMMODITY	AREA	CLASSIFICATION LEVEL	CONFIDENCE LEVEL	REMARKS
Metals	Entire GRA	2	B	Hg
Geothermal	Entire GRA	2	B	
Uranium/Thorium	Entire GRA	1	A	
Coal	Entire GRA	2	B	
Oil and Gas	Entire GRA	2	A	
Tar Sands/Oil Shale	Entire GRA	1	C	
Limestone	Entire GRA	1	C	
Bentonite	Entire GRA	3	C	
Diatomite	Entire GRA	3	A	
Clinoptilolite	Entire GRA	1	A	
Paleontology	S.W. Part of GRA	4	D	
	Rest of GRA	1	B	
Hazards	See Hazards Map (GRA File)			
ESLs	None	1	C	

LEGEND:
Class 1 - Least Favorable
Class 2 - Low Favorability
Class 3 - Moderate Favorability
Class 4 - High Favorability

Confidence Level A - Insufficient data or no direct evidence
Confidence Level B - Indirect evidence available
Confidence Level C - Direct evidence but quantitatively minimal
Confidence Level D - Abundant direct and indirect evidence

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5. RECOMMENDATIONS FOR FUTURE WORK

Further work in the Guano Valley GRA should be designed to increase the confidence levels of the classifications. Detailed surface investigations should be undertaken for recognition criteria for industrial minerals (e.g., weathering phenomena that might produce bentonite, clinoptilolite; ash flow tuffs with possible basal vitrophyres for perlite, etc.); for metallic deposits, such as soil chemistry, stream sediment analyses, etc. With the exception of either geophysical investigations or drilling, future work should be confined to detailed mapping, geochemical sampling, and general field exploration.

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- APPENDIX A -

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